pletion in the process of the filling of levels in the simple single-particle shell model may be an oversimplification because this is just the region where the strong surface coupling caused by large spheroidal distortion[10–13] or configuration interaction[14–18] of several nucleons may be important. In this connection one might expect on the basis of either the Bohr-Mottelson[12] strong surface coupling model or the de-Shalit-Goldhaber[15] configuration interaction arguments regarding trends of first excited state energies, that if the nucleon configuration at $N=152$ involves only completely filled levels, the first excited state energies should approach a maximum as is observed in the closing of other shells[19–21]; the experimental evidence so far indicates that this is not the case.[4,22] Thus it seems that the 152-neutron subshell may be of a fundamentally different nature than the major closed shells.

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Q Value of Λ^0 Decay

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MEASUREMENTS of the energy release or Q value in Λ^0 decay have previously been reported.[1] From the photographs obtained in the 48-in. magnet cloud chambers now operating in Pasadena, a set of the most accurately measurable Λ^0 decays have been selected for calculations of Q values.

In order to be selected, a Λ^0 decay was required to have a heavily ionizing positive secondary whose mass was clearly consistent with the proton mass. Furthermore, the estimated probable error in the Q value was required to be less than or equal to ± 5 Mev. These severe restrictions were practical because the design of the cloud chambers enable a large number of decays of very slow Λ^0 particles to be detected. It is possible to photograph decays which occur as close as 0.5 cm to the brass chamber wall and 1 cm to the lead plate above the chamber. Also the large depth of the illuminated region (23 cm) allowed detection of many unstable particles emitted at large angles to the vertical direction. There were 19 cases which satisfied the selection criteria.

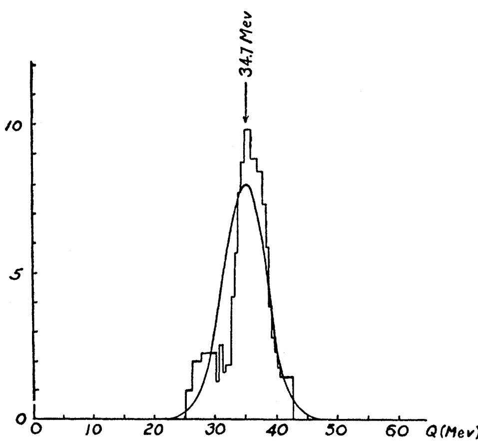

FIG. 1. Distributions of measured Q values for 19 selected cases of Λ^0 decay. Each case is represented in this distribution by a block 5 Mev wide and of a height inversely proportional to the square of the estimated probable error. A case whose estimated probable error is ± 3 Mev is assigned a height of one unit. A Gaussian curve of the same total area corresponding to a probable error of ± 2.5 Mev is shown for comparison.

The Q value of each Λ^0 decay, assuming the only products to be a proton and a π meson, was calculated from the measured momenta of the secondaries and the angle between their initial lines of flight. The errors in the momenta were calculated from the estimated maximum momentum detectable in the chamber. The contribution to the error in the Q value ΔQ arising from errors in measurement of the angle between the tracks was in all cases negligible.

The distribution shown in Fig. 1 was constructed by assigning to each of the 19 cases a "block" 5 Mev wide (centered about the calculated Q value) and a height inversely proportional to the square of the assigned error. A Gaussian curve of the same area and a width corresponding to a probable error of ± 2.5 Mev fits this distribution quite well. The best Q value for the decay $\Lambda^0 \rightarrow p^+ + \pi^-$ is thus indicated to be 34.7 Mev.

The statistical probable error in the mean Q value is calculated to be ± 0.6 Mev. The presence of systematic errors in the calibration of the magnetic field has been considered, and such errors are estimated to contribute possibly ± 0.5 Mev to the error in the Q value. Therefore, the best Q value derived from these data is (34.7 ± 1) Mev.

All the cases from the 48-in. magnet cloud chambers which have been analyzed to date and which clearly have a positive secondary heavier than a π meson are consistent with the decay scheme $\Lambda^0 \rightarrow p^+ + \pi^- + (34.7 \pm 1)$ Mev. However, the selection of cases for measurement is biased toward low-energy cases and the possible existence of a small number of cases with other Q values is not ruled out.

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Effect of the Melting of Polar Ice on the Length of the Day

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THE astronomical standard of time assumes the constancy of the rotation of the earth. There is good evidence today[1] that the rotation of the earth is not constant, and has in it both regular periodic variations and irregular fluctuations of considerable amplitude. It is the purpose of this note to evaluate quantitatively the effect of one possible cause of such fluctuation, namely, the melting of polar ice.

In this computation we shall take the moment of inertia of the earth as 8.1×10^{44} gram cm^2. This figure is obtained by taking the mass of the earth as 5.97×10^{27} grams, and assuming that the density increases linearly toward the center, with a positive discontinuity of about 5 g/cc at the interface between the core and mantle. As a numerical example, to show how little the exact form of density variation matters, we mention that if the earth's density were uniform and equal to its average value, the moment of inertia would be 9.55 of the above units. If we suppose the density d to be a function of radius r and a constant k as $d = d_0 - kr$, where d_0 is the central density, then the moment of inertia is given by

$$I = \int_0^\pi \int_0^R r^2 \sin^2\theta (d_0 - kr) 2\pi r \sin\theta \cdot r d\theta dr, \qquad (1)$$

which integrates into

$$I = (4\pi R^3/3)[(2d_0R^2/5) - (kR^3/3)]. \qquad (2)$$

For the core, we take d_0 as 18, k as 2.48×10^{-8} g/cm^4 and the core radius as 3450 km. With these figures, the contribution due to the core is 0.863×10^{44} g cm^2, or about one tenth that of the mantle. The exact values of the density variation with depth k is quite unimportant as is also the absolute value of the central density.

Assuming next that angular momentum is conserved, that small changes occur in the moment of inertia I, and writing ω for the angular velocity, numerically equal to 8.64×10^4 sec/day or 7.25×10^{-5} radian per sec, we have if we neglect the squares of small quantities:

$$dI/I = -d\omega/\omega, \qquad (3)$$

where dI is the change in the moment of inertia and the resulting change in the rotational speed is $d\omega$. Further, the moment of inertia of a thin shell of radius r and mass m is $\frac{2}{3}mr^2$, and a cubic km of ice weighs 10^{15} grams times its specific gravity. Thus a cubic km of ice on the Greenland ice cap, at an average distance of $\frac{1}{6}$ the earth's radius, some 1000 km from the rotational axis, has a moment of inertia of 10^{31} g cm^2.

Suppose next that this ice melts and is spread into a uniform shell about the earth, with a radius r of 6.3×10^8 cm. Then its moment of inertia will be 26×10^{31} g cm^2. Therefore it does not matter, within a few percent, whether the ice was assumed originally in Greenland or nearer the pole of rotation. One cubic kilometer of ice, more or less polar, will therefore cause a change dI/I of 3×10^{-13} if it melts.

The Greenland ice cap is about 1.75×10^6 sq km in area, and the ice is known in many places to average 1 km in thickness, so we have roughly 10^7 cubic km of ice. If the entire surface lowers by as little as 10 cm, then 10^3 cubic km will have melted. Such lowering would cause a change in rotation $d\omega/\omega$ of 3×10^{-10} or about 26 microseconds per day. The abundant geological evidence in the form of nunataks and other glacially eroded formations testifies that the lowering of the Greenland ice cap has, over a period of many years, exceeded our 10-cm figure by substantially more than three orders of magnitude. If the entire Greenland ice cap were to melt, the change would amount to 100 sec/year.

In Antarctica, the latest expedition[2] found the ice to be thicker than previously supposed, and found thicknesses of 2 to 3 km in many places. If we take 2 km as an average, the area being about 15×10^6 km,[2] the ice volume is 30×10^6 cu km. An average change in Antarctica of 3 cm in the ice level would produce the